

239  
533.12

299  
107.6

400,836 COMPLETE SPECIFICATION

1 SHEET

FIG. 1

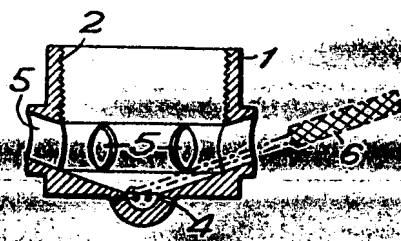


FIG. 2

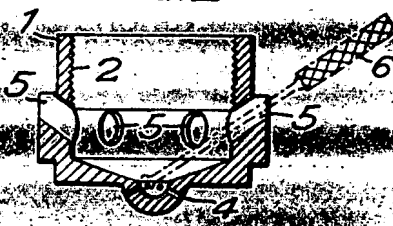


FIG. 3

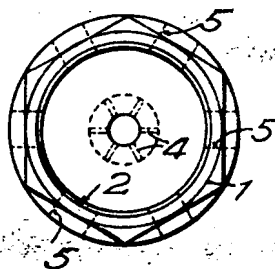


FIG. 4

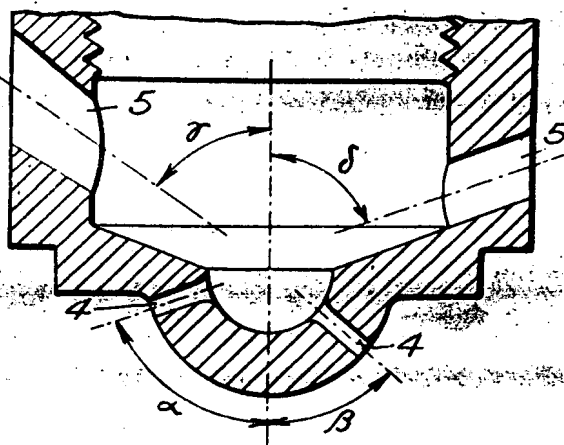


FIG. 5

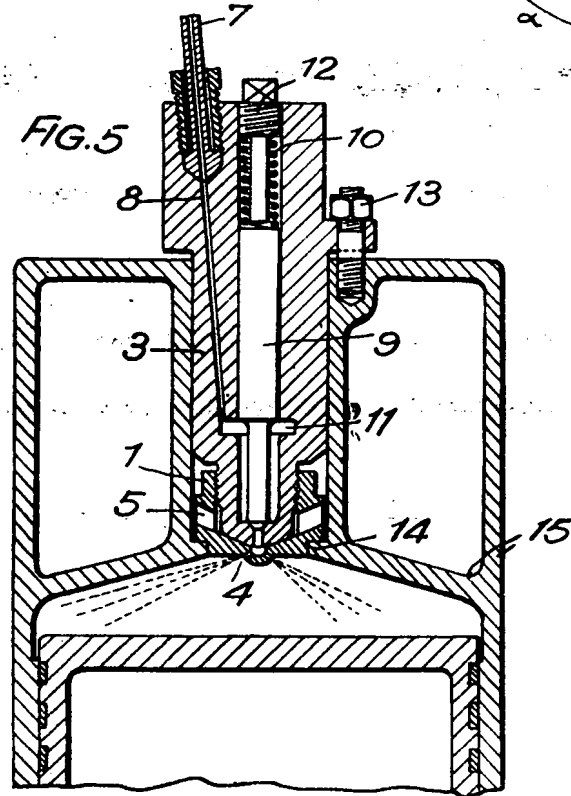


FIG. 6

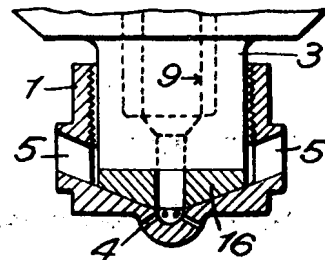
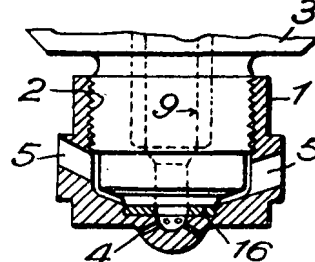


FIG. 7



[This Drawing is a reproduction of the Original on a reduced scale.]

## PATENT SPECIFICATION

Convention Date (Switzerland): March 19, 1932.

Application Date (in United Kingdom): March 13, 1933. No. 4641/33

Complete Accepted: Nov. 2, 1933.

## COMPLETE SPECIFICATION



We, SCHWEIZERISCHE LOKOMOTIV-UND MASCHINENFABRIK of Winterthur, Switzerland, a joint stock company, incorporated under the Laws of Switzerland, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:

10 This invention relates to fuel nozzles for internal combustion engines and it consists in the particular construction of the body of the nozzle piece and the arrangement of the passages for the fuel therein. It is a known fact that the coefficient of flow for apertures of equal diameters differs depending whether the apertures are provided with sharp or rounded edges, or whether the edges are formed with burrs. Other nozzles constructed by the usual methods are provided with entrance ports to the fuel passages which are sharp or burr-edged. In consequence thereof the coefficients of flow vary very often to a great extent so that the injection operation is thereby affected. Edges of this kind also facilitate the formation of sediments such as coke and the like, thus increasing the resistance opposed to the flow.

According to the present invention, a construction for the nozzle piece is provided which permits of working the extrusion passages, for example by applying rounded portions to the entrance ports of the same, during the manufacture of the nozzle piece in that behind the fuel extrusion passages as regards the direction of flow of fuel through the same and in a corresponding radial relationship thereto supplementary circumferential apertures are provided in the wall of said nozzle piece, said extrusion passages for the fuel and said supplementary apertures being separated from one another by a sealing face for the compressed fuel.

This arrangement provides very simple means for effectively sealing the combustion chamber and for distributing the fuel to all portions of this chamber, so that a uniform combustion is ensured, while at the same time the fuel extrusion passages can be worked and cleaned from the inner

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side, thus rendering possible the extrusion of the fuel at a minimum resistance to its flow at all times.

In the accompanying drawings constructional forms of the invention are shown by way of example only, in which

Figs. 1 and 2 represent axial sections through two different nozzle pieces according to the invention;

Fig. 3 is a plan view of Fig. 1

Fig. 4 shows a section of a further modification on a larger scale.

Fig. 5 illustrates an axial section of the cylinder cover with which the nozzle is combined, and

Figs. 6 and 7 show in two similar sectional elevations details of different nozzles.

Referring to the drawings, the nozzle piece and the cylinder cover apparatus to which the piece it may be firmly connected, for example by means of a screw thread 2, or else the nozzle piece may be loosely mounted on the

By 4 the extrusion passages for the fuel are designated. Behind these passages, as regards the direction of flow of the fuel through the same, supplementary circumferential apertures 5 are provided in a corresponding radial relationship thereto through which apertures

tools 6 can be inserted by means of which the passages 4 are adapted to be worked from the inner side, as reamed, counter-sunk, rounded off at the inner edge and the like, and also cleaned.

The passages 4 are accommodated in a spherically embossed portion of the nozzle piece 1, this portion being the sole part of said piece projecting into the combustion chamber, thus rendering possible the projection of the fuel to all portions of the combustion chamber (Fig. 5). The arrangement is such that the fuel can be supplied to this spherical portion through a central short bore only. The inner surface of the nozzle piece i.e. the surface of the nozzle piece which substantially separates the passages 4 from the apertures 5 is thus adapted to serve as a sealing face to prevent high pressure fuel from escaping between the nozzle piece 1 and the body 3 or an intervening packing element respectively.

The passages 4 are adapted to be worked from the inner side, as reamed, counter-sunk, rounded off at the inner edge and the like, and also cleaned.

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In the arrangement shown in Figs. 1 and 3 the axes of the extrusion passages 4 and those of the supplementary circumferential apertures 5 are parallel.

In Fig. 2 the axes of the extrusion passages 4 are disposed at a smaller angle to the axis of the nozzle piece 1 than the axes of the supplementary circumferential apertures 5, as regards the downward direction of the axis of the nozzle piece.

In Fig. 4 the axes of the extrusion passages 4 are at different angles  $\alpha$  and  $\beta$  to the axis of the nozzle piece 1. In this arrangement, extrusion passages directed at different angles  $\alpha$ ,  $\beta$  may be divided evenly about the axis of the nozzle piece in order to ensure a proper and even distribution of the fuel in the combustion chamber. In a similar manner as the passages 4 the supplementary apertures 5 may be arranged at different angles  $\gamma$ ,  $\delta$  to the axis of the nozzle piece.

In Fig. 5, by 7 the fuel supply conduit is designated and by 8 the fuel supply passage in the body 3 of the apparatus, whereas 9 refers to the fuel control valve, which may be so arranged that it is opened by the action of the fuel pressure in the admission chamber 11 and closed by a spring 10. An adjustable plug 12 serves for adjusting the force exerted by the spring 10. The lower end face of the body 3 of the apparatus is pressed against the mating interior face of the nozzle piece 1, by means of the screw connection 2 between these two parts, so as to provide a tight sealing against leakage of high pressure fuel. Screws or bolts 13 are provided for pressing the nozzle piece 1, by means of the body 3, against shoulders 14 on the cylinder cover 15, for closing the combustion chamber. The tight sealing effect between the body 3 and the nozzle piece 1, as required, can be obtained by pressing these two parts directly against each other or indirectly through an intervening packing element 16 (see Figs. 6 and 7).

As shown in Fig. 6, the nozzle piece is a loose fit on the body 3, so as to leave a clearance space between these parts. In this case sealing is provided by means of the packing 16 alone, the latter being compressed to the necessary extent by the bolts 13.

In the example represented in Fig. 7 the packing is inserted between two plane surfaces of the nozzle piece 1 and the body 3 respectively.

As aforesaid, the extrusion passages

for the fuel and the supplementary apertures may be arranged in different angular relationship of their axes with the axis of the nozzle piece. Thus, in one and the same nozzle piece the angle between the axis of one of the fuel extrusion passages and the axis of the nozzle piece may be larger than the angle between the axis of another fuel extrusion passage and the axis of the nozzle piece (Fig. 4). By this means not only the fuel is evenly distributed to all portions of the combustion chamber, but also all the air is caused to take part in the ignition simultaneously or nearly so. It is obvious that in this case also the angles  $\gamma$  and  $\delta$  between the axes of the supplementary apertures and the axis of the nozzle piece of the apparatus are varied, so that always an extrusion passage 4 and a supplementary aperture 5 are correlated to each other to provide accessibility to the former through the latter by means of a tool, as is shown in Fig. 4.

The invention may also be applied to fuel injection apparatus having an open nozzle arrangement, thus being devoid of a needle 9 (Fig. 5) for regulating the distribution of the fuel. All the arrangements as shown in the Figs. 1-7 are readily adaptable to fuel nozzles of this type.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. A fuel injection apparatus for internal combustion engines, including a nozzle piece comprising fuel extrusion passages, characterised by the fact that behind the fuel extrusion passages as regards the direction of flow of fuel through the same and in a corresponding radial relationship thereto supplementary circumferential apertures are provided in the wall of said nozzle piece, said extrusion passages for the fuel and said supplementary apertures being separated from one another by a sealing face for the compressed fuel.

2. A fuel injection apparatus for internal combustion engines, including a nozzle piece comprising fuel extrusion passages, substantially as described and as illustrated in the accompanying drawings.

Dated this 13th day of March 1933.  
MARKS & CLERK.